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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/692,470	10/20/00	YAMAMOTO	S

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RICHARD L SCHWAAB
FOLEY & LARDNER WASHINGTON HARBOUR
PO BOX 25696
3000 K ST NW STE 500
WASHINGTON DC 20007-8696

EXAMINER	
NGUYEN, T	
ART UNIT	PAPER NUMBER
3748	4

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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.	Applicant(s)
09/692,470	Yamamoto et al.
Examiner	**Art Unit**
Tu M. Nguyen	3748

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☐ Responsive to communication(s) filed on _____

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideratio

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-18 and 23-29* is/are rejected.

7) ☒ Claim(s) *19-22* is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on *Oct 20, 2000* is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☒ None of:

1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)
16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 3
18) ☐ Interview Summary (PTO-413) Paper No(s). _____
19) ☐ Notice of Informal Patent Application (PTO-152)
20) ☐ Other:

DETAILED ACTION

Drawings

1. The drawings are objected to because

- Figure 20, step P308 is not described in the specification.

- Figure 22, "P509" should read --P504--.

Correction is required.

Specification

2. The abstract of the disclosure is objected to because of the use of open ended phrase "comprise" on line 3. Correction is required. See MPEP § 608.01(b).

3. The disclosure is objected to because of the following informalities:

- Page 1, line 31, the sentence ending with "reaction of" appears to be incomplete.

- Page 28, line 31, "cocentration" should read --concentration--.

- Page 57, line 20, "flat" should read --flag--.

Appropriate correction is required.

Claim Objections

4. Claim 16 is objected to because on page 79, line 22, --oxidation-- should be inserted following "selective". Appropriate correction is required.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office Action:

> A person shall be entitled to a patent unless --
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-3, 7, 8, 10, 11, 13, 14, and 26-29 are rejected under 35 U.S.C. 102(b) as being anticipated by Oshima et al. (U.S. Patent 5,412,946).

Re claims 1, 13, 28, and 29, as shown in Figure 9, Oshima et al. disclose an exhaust gas purifying system and an exhaust gas purifying method of a multiple step control type in combination with an internal combustion engine (119) having an exhaust gas passageway, the engine includes a combustion system having a combustion control device (the ECU is shown in Figure 1) for controlling at least one selected from the group consisting of operating parameters of the engine and combinations of the operating parameters, the operating parameters including fuel injection timing, spark timing, opening and closing timings of intake and exhaust valves of the engine. The exhaust gas purifying system includes:

- a NOx treating catalyst (12) for reducing NOx disposed in the exhaust gas passageway to reduce NOx in presence of reducing components in exhaust gas, and

- a hydrogen enriching device (120) disposed upstream of the NOx treating catalyst with respect to flow of exhaust gas and including a device for supplying hydrogen-contained gas

produced by using hydrocarbon fuel and air, from outside of the exhaust passageway, the hydrogen-contained gas supplying device including at least one of a first hydrogen-contained gas supplying device having a hydrogen-contained gas producing catalyst (120) for promoting reaction for producing hydrogen-contained gas from the hydrocarbon fuel, and a device (121,122) for supplying the hydrocarbon fuel and air to the catalyst,

the hydrogen enriching device being arranged to increase a ratio of hydrogen to total reducing components in a combustion gas so as to relations represented by the following formulae (1) and (2), when reduction of NOx is carried out by the NOx treating catalyst:

$$[H2 / TR]d > [H2 / TR]u \quad (1)$$

$$[H2 / TR]d \geq 0.3 \quad (2)$$

where [H2 / TR]u is a ratio between a concentration [H2]u of hydrogen and a concentration [TR]u of total reducing components in exhaust gas in the exhaust gas passageway upstream of the hydrogen enriching device; and [H2 / TR]d is a ratio between a concentration [H2]d of hydrogen and a concentration [TR]d of total reducing components in exhaust gas in the exhaust gas passageway upstream of the NOx treating catalyst and downstream of the hydrogen enriching device.

In formula (1), [H2 / TR]u is approximately zero as only a trace amount of hydrogen is produced from the combustion engine. [H2 / TR]d is equal to the ratio of {[H2]u+[H2]} and {[TR]u+[TR]}, where [H2] and [TR] are the concentration of hydrogen and total reducing components from the hydrogen enrichment device, respectively. Per molar basis, [H2]u is

approximately zero; and with the second chemical reaction in column 4, [H2] and [TR] are 1 and 2, respectively. Therefore, [H2 / TR]d is equal to 1/{2+[TR]u} which is clearly greater than zero. Thus, formula (1) is inherently satisfied when the hydrogen enrichment device is active and producing a mixture containing hydrogen in accordance to the second chemical reaction in column 4. In formula (2), as shown earlier, [H2 / TR]d = 1/{2+[TR]u} and is greater than or equal to 0.3 only if [TR]u is less than 1.33 mole. It is hereby argued that [TR]u is negligible as the exhaust gas must pass through the oxidizing catalyst (9) where a majority amount of HC and CO is oxidized. Hence, formula (2) is inherently satisfied when the hydrogen enrichment device is active and producing a mixture containing hydrogen in accordance to the second chemical reaction in column 4 and when there exists an oxidizing catalyst (9) located upstream of the NOx treating catalyst (12).

Re claims 2 and 14, in the exhaust gas purifying system of Oshima et al., the hydrogen enriching device is arranged to increase a ratio of hydrogen to carbon monoxide in the total reducing components in exhaust gas so as to meet a relation represented by the following formula [H2 / CO]d > 1 where [H2 / CO]d is a ratio between a concentration [H2]d of hydrogen and a concentration [CO]d of carbon monoxide in the total reducing components in exhaust gas in the exhaust gas passageway immediately upstream of the NOx treating catalyst and downstream of the hydrogen enriching device, when reduction of NOx is carried out by the NOx treating catalyst. In the device shown in Figure 9, as discussed above, [H2]u and [CO]u of the exhaust gas passing through the oxidizing catalyst (9) are approximately zero. Thus, [H2 / CO]d is simply equal to

[H2 / CO] of the hydrogen enrichment device; and [H2 / CO]d is clearly greater than or equal to one when the hydrogen enrichment device is active and producing a mixture containing hydrogen in accordance to the second chemical reaction in column 4 and when there exists an oxidizing catalyst (9) located upstream of the NOx treating catalyst (12).

Re claim 3, in the exhaust gas purifying system of Oshima et al., the hydrogen enriching device is a device for introducing hydrogen into at least one of combustion gas and exhaust gas.

Re claim 7, in the exhaust gas purifying system of Oshima et al., the device for introducing hydrogen into the exhaust gas is a device for supplying hydrogen-contained gas produced by using hydrocarbon fuel and air, from outside of the exhaust passageway.

Re claim 8, in the exhaust gas purifying system of Oshima et al., the device for supplying hydrogen-contained gas includes a hydrogen-contained gas producing catalyst (120) for promoting reaction for producing hydrogen-contained gas from the hydrocarbon fuel, and a device (121,122) for supplying the hydrocarbon fuel and air to the catalyst (see Figure 9).

Re claim 10, in the exhaust gas purifying system of Oshima et al., the hydrogen-contained gas supply device includes a device (121) for decreasing the amount of hydrocarbon fuel to be supplied and a device (122) for increasing the amount of air to be supplied so as to increase a concentration of oxygen, when the temperature of the hydrogen-contained gas producing catalyst is lower than a level (lines 31-35 of column 4). Also see Figure 1 and line 65 of column 5 to line 7 of column 6.

Re claim 11, in the exhaust gas purifying system of Oshima et al., the hydrogen-contained gas supply device includes a device for producing hydrogen-contained gas by using hydrocarbon fuel and exhaust gas under heat. This is clearly inherent as the chemical reaction in the catalyst (120) is an endothermic one and the catalyst (120) is placed within the exhaust passage to utilize the heat from the exhaust gas to sustain the reaction.

Re claim 26, the combustion device in the exhaust gas purifying system of Oshima et al. is an internal combustion engine.

Re claim 27, the internal combustion engine in the exhaust gas purifying system of Oshima et al. is a gasoline-fueled engine for an automotive vehicle (see Figure 6 and lines 53-56 of column 6).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 4, 18, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima et al. as applied to claim 3 above, in view of Bartley (U.S. Patent 6,244,044).

Re claim 4, the system of Oshima et al. cited above comprises a combustion control device, (7) in Figure 1, for controlling the operating parameters of an internal combustion engine, the operating parameters including fuel injection timing, spark timing, opening and closing timings of intake and exhaust valves of the internal combustion engine. Oshima et al., however, fail to disclose that the hydrogen enrichment device is a device for producing hydrogen in the exhaust gas, that includes a hydrogen producing catalyst containing at least one noble metal.

Bartley teaches a method for reducing cold-start hydrocarbon emissions, that utilizes a hydrogen producing catalyst (16) containing rhodium for the production hydrogen in the exhaust gas during a fuel rich operation (see the Abstract and lines 17-20 of column 4). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the catalyst taught by Bartley in the system of Oshima et al., since the use thereof would have provided an effective means to provide hydrogen gas for the effective reduction of NOx emissions at the NOx treating catalyst.

Re claim 18, in the modified exhaust gas purifying system of Oshima et al., the hydrogen producing catalyst has a function to produce hydrogen from HC and CO in the exhaust gas.

Re claim 23, the modified exhaust gas purifying system of Oshima et al. further comprising a device (fuel injector) for controlling exhaust gas a position upstream of the hydrogen producing

catalyst to intermittently have a composition in which air-fuel ratio is rich, so as to raise efficiency of production of hydrogen by the hydrogen producing catalyst.

9. Claims 5 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima et al. as applied to claim 3 above, in view of Bartley and Kumar et al. (U.S. Patent 6,151,547).

Re claim 5, the exhaust gas purifying system of Oshima et al. discloses the invention as cited above, however, fails to disclose that the hydrogen enrichment device is a device for decreasing the reducing components other than hydrogen in the exhaust gas; the device includes a CO and HC selective oxidation catalyst containing zirconium oxide, for selectively oxidize CO and HC.

Bartley teaches a method for reducing cold-start hydrocarbon emissions, that utilizes a hydrogen producing catalyst (16) containing rhodium for the production hydrogen from the oxidizing of CO and HC in the exhaust gas during a fuel rich operation (see the Abstract and lines 17-20 of column 4). Bartley, however, fails to disclose that the catalyst (16) contains zirconium oxide as a stabilizer.

Kumar et al. teach that it is conventional in the art to utilize zirconium oxide as a stabilizer in a catalytic converter (lines 5-12 of column 16).

It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the catalyst taught by Bartley and Kumar et al. in the system of Oshima et al., since the use thereof would have provided an effective means to reduce the

concentration of HC and CO in the exhaust gas so that the light-off temperature to reduce NOx in the NOx treating catalyst can be lowered.

Re claim 15, in the modified exhaust gas purifying system of Oshima et al., the CO and HC selective oxidation catalyst has a function of producing hydrogen and contains rhodium and zirconium oxide, the zirconium oxide containing alkaline earth metal and having a composition represented by the following general formula (3):

$$[X]aZrbOc \qquad (3)$$

where X is an alkaline earth metal selected from the group consisting of magnesium, calcium, strontium and barium (Kumar et al.: lines 41-48 of column 15 and lines 5-12 of column 16); a and b are ratios of atoms of elements, and c is a number of oxygen atoms required for satisfying valences of X and Zr, in which a is within a range of from 0.01 to 0.5, b is within a range of from 0.5 to 0.99, and a+b= 1.0.

10. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima et al. in view of Bartley and Kumar et al. as applied to claim 15 above, and further in view of design choice.

In the modified exhaust gas purifying system of Oshima et al., the CO and HC selective oxidation catalyst further contains palladium and cerium oxide (line 65 of column 16 to line 39 of column 17). Oshima et al., however, fail to disclose that the palladium is carried in an amount ranging from 20 to 80% by weight of total palladium on cerium oxide.

With regard to applicants claim directed to a specified percentage amount of the total palladium on cerium oxide, the specification of such would have been an obvious matter of design choice well within the level of ordinary skill in the art depending on design variables, such as the amount of cerium oxide, cost and availability of palladium, operating environment of the catalyst, etc . Moreover, there is nothing in the record which establishes that the specification of such presents a novel of unexpected result (See *In re Kuhle*, 526 F.2d 553, 188 USPQ 7 (CCPA 1975)).

6, 17 and 31-32

11. Claims 6 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima et al. as applied to claim~~s~~ 1 and 30 above, in view of Kobayashi et al. (U.S. Patent 5,124,303) and Tauster et al. (U.S. Patent 4,149,998).

Re claim 6, the 31 exhaust gas purifying system of Oshima et al. discloses the invention as cited above, however, fails to disclose that the hydrogen enrichment device is a device for suppressing consumption of hydrogen in at least one of combustion gas and exhaust gas; and that the device is a catalyst containing solid acidic zirconium oxide.

Kobayashi et al. teach a catalyst for treatment of waste gas, that contains solid acidic zirconium oxide. Tauster et al. teach that catalysts that contain an oxide of zirconium is known to suppress the chemisorption of hydrogen (see the Abstract). Therefore, the catalyst in Kobayashi et al. can suppress the consumption of hydrogen in the exhaust gas. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the catalyst taught by Kobayashi et al. and Tauster et al., in the system of Oshima et al., since the use

thereof would have provided an effective system to remove harmful emissions in the exhaust gas of internal combustion engines.

Re claim 17, in the modified exhaust gas purifying system of Oshima et al., the catalyst containing solid acidic zirconium oxide contains platinum, the solid acidic zirconium oxide containing at least one element selected from the group consisting of titanium, aluminum tungsten, molybdenum and zinc, the solid acidic zirconium oxide having a composition represented by the following general formula (4):

$$[Y]dZreOf \qquad (4)$$

where Y is at least one element selected from the group consisting of titanium, aluminum, **tungsten**, molybdenum and zinc; d and e are ratios of atoms of elements; and f is a number of oxygen atoms required for satisfying valences of Y and Zr, in which d is within a range of from 0.01 to 0.5, e is within a range of from 0.5 to 0.99, and d+e = 1.0. See Example 3 in Kobayashi et al.

Re claim 32

12. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima et al. as applied to claim 8 above, in view of Ruka et al. (U.S. Patent 5,498,487) and Negishi (U.S. Patent 6,165,633).

In the system of Oshima et al. cited above, the amounts of hydrocarbon fuel and air to be supplied to the hydrogen-contained gas producing catalyst are controlled in accordance with the temperature of the hydrogen-contained gas producing catalyst (see Figure 1 and line 65 of column 5 to line 7 of column 6). Oshima et al., however, fail to disclose that the hydrogen-contained gas

supply device further includes an oxygen concentration sensor disposed upstream of the hydrogen-contained gas producing catalyst so as to detect a concentration of oxygen, and a temperature sensor disposed downstream of the hydrogen-contained gas producing catalyst so as to detect a temperature of the hydrogen-contained gas producing catalyst.

Ruka et al. teach that it is conventional in the art to utilize an oxygen sensor disposed upstream of the hydrogen-contained gas producing catalyst to detect a concentration of oxygen (lines 30-33 of column 4).

As shown in Figure 1, Negishi teaches that it is conventional in the art to utilize a temperature sensor (62) disposed downstream of the hydrogen-contained gas producing catalyst (22) so as to detect a temperature of the hydrogen-contained gas producing catalyst, wherein amounts of hydrocarbon fuel and water to be supplied to the hydrogen-contained gas producing catalyst are controlled in accordance with the temperature of the hydrogen-contained gas producing catalyst.

It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the oxygen sensor and the temperature sensor taught by Ruka et al. and Negishi, respectively, in the system of Oshima et al., since the use thereof would have provided an effective means to control the production of hydrogen gas for the reduction of harmful emissions in the exhaust gas of internal combustion engines.

13. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima et al. as applied to claim 7 above, in view of Murphy et al. (U.S. Patent 6,122,909).

The exhaust gas purifying system of Oshima et al. discloses the invention as cited above, however, fails to disclose that the hydrogen-contained gas supply device includes a device for temporarily storing hydrogen-contained gas which has been produced, before being supplied to the NOx treating catalyst.

As shown in Figure 1, Murphy et al. teach an exhaust gas purification device that includes a device (52) for temporarily storing hydrogen-contained gas which has been produced, before being supplied to the NOx treating catalyst (31). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the hydrogen storage device taught by Murphy et al. in the system of Oshima et al., since the use thereof would have provided a source of hydrogen to purify exhaust gas when the hydrogen enrichment device is not active.

14. Claims 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Oshima et al. as applied to claim 1 above, in view of Kaneko et al. (U.S. Patent 6,173,571).

Re claim 24, the NOx treating catalyst of Oshima et al. cited above contains platinum. Oshima et al., however, fail to disclose that the NOx treating catalyst also contains at least one substance selected from the group consisting of alumina, alkali metal and alkaline earth metal.

Kaneko et al. teach that it is conventional in the art to utilize a NOx treating catalyst containing at least one substance selected from the group consisting of alumina, alkali metal and

alkaline earth metal (lines 10-16 of column 8). It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the NOx treating catalyst taught by Kaneko et al. in the system of Oshima et al., since the use thereof would have provided an effective NOx treating catalyst to purify exhaust gas from internal combustion engines.

Re claim 25, in the exhaust gas purifying system of Oshima et al., the NOx treating catalyst contains at least rhodium (Kaneko et al.: lines 10-16 of column 8) and arranged to be capable of reducing NOx in exhaust gas at a temperature ranging from 260 to 380°C (Oshima et al.: curve B in Figure 19).

Allowable Subject Matter

15. Claims 19-22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Prior Art

16. The IDS (PTO-1449) filed on October 20, 2000 has been considered. An initialized copy is attached hereto.

17. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure and consists of five patents.

- Schmidt (U.S. Patent 3,986,350) discloses a method of and an apparatus for improved methanol operation of combustion systems.

- Oshima et al. (U.S. Patent 5,272,871) disclose a method and apparatus for reducing NOx from internal combustion engine.

- Yamamoto et al. (U.S. Patent 6,047,544) disclose an engine exhaust gas purification catalyst and exhaust gas purifier.

- Balko et al. (U.S. Patent 6,176,078) disclose a plasma fuel processing for NOx control of lean burn engines.

- McCabe (U.S. Patent 6,187,709) discloses a palladium catalyst pre-oxidation to reduce light-off temperature.

Communication

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Tu Nguyen whose telephone number is (703) 308-2833.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Thomas E. Denion, can be reached on (703) 308-2623. The fax phone number for this group is (703) 308-7763.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0861.

Tu M. Nguyen

TMN

June 27, 2001

Tu M. Nguyen

Patent Examiner

Art Unit 3748

Thomas Denion

THOMAS DENION
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 3700